

# PATENT ABSTRACTS OF JAPAN

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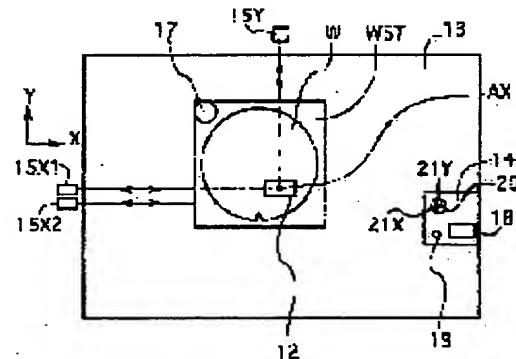
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## (54) EXPOSURE SYSTEM

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To downsize a stage for positioning a reticle or a wafer, after maintaining a condition of exposure light or a function of measuring an imaging performance.

**SOLUTION:** A wafer W is mounted on a wafer stage WST, which is so provided as to freely move to an X-direction and to a Y direction on a fixed plate 13, a pattern image of a reticle is exposed within an exposure region 12 on the wafer W and the exposure is performed by sweeping the reticle and the wafer toward the Y-direction. A stage 14 for measuring is provided freely movable in to the X-direction and to the Y-direction on the fixed plate 13 independently of the wafer stage WST and a space image detecting system, including a radiating amount monitor 18, a radiating unevenness sensor 19 and a measuring board 20, through which a slit is formed is installed on the stage 14 for measuring. Since the wafer state WST may be provided with a minimum functions which are only required for making the exposure, the wafer stage can be downsized and made light-weight.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The 1st stage which holds either of said masks and said substrates, and moves in a predetermined field in the aligner which imprints on a substrate the pattern formed in the mask using an exposure beam, and said 1st stage are an aligner characterized by to have the 2nd independent stage and the metering device which is attached in this 2nd stage and measures the condition of said exposure beam.

[Claim 2] It is the aligner characterized by being an aligner according to claim 1 and said 2nd stage being arranged by said 1st stage independently free [ migration ].

[Claim 3] The aligner which is an aligner according to claim 1 and is characterized by having the control unit to which said 1st stage is moved between the location where said exposure beam is irradiated, and the location where said exposure beam is not irradiated.

[Claim 4] The aligner which is an aligner according to claim 2 and is characterized by having the control unit to which said 2nd stage is moved between the location where said exposure beam is irradiated, and the location where said exposure beam is not irradiated.

[Claim 5] The aligner which is an aligner according to claim 1 and is characterized by having the control unit which positions said 2nd stage in the location where said exposure beam is not irradiated when it is in the location where said 1st stage can irradiate said exposure beam.

[Claim 6] the 2nd stage where the 1st stage which holds said substrate and moves in a predetermined field in the aligner which projects on a substrate the pattern formed in the mask through projection optics, and said 1st stage became independent -- this -- the aligner characterized by to have the metering device which is arranged on the 2nd stage and measures the image formation property of said projection optics.

[Claim 7] It is the aligner characterized by being an aligner according to claim 6 and said 2nd stage being arranged by said 1st stage independently free [ migration ].

[Claim 8] The aligner which is an aligner according to claim 6 and is characterized by having the control unit to which said 1st stage is moved between the location in the exposure field by said projection optics, and the position of the outside of this exposure field.

[Claim 9] The aligner which is an aligner according to claim 6 and is characterized by having the control unit to which said 2nd stage is moved between the location in the exposure field by said projection optics, and the position of the outside of this exposure field.

[Claim 10] The aligner characterized by having the stage where the metering device which measures the condition of said exposure beam has been arranged in the aligner which imprints on a substrate the pattern formed in the mask using an exposure beam, and the cooling system with which this stage is equipped, and which cools said metering device.

[Claim 11] The aligner characterized by having the stage where the metering device which measures the image formation property of said projection optics has been arranged in the aligner which projects on a substrate the pattern formed in the mask through projection optics, and the cooling system with which this stage is equipped, and which cools said metering device.

[Claim 12] In the aligner which imprints on a substrate the pattern formed in the mask using an exposure beam The 1st stage which holds either of said masks and said substrates, and moves in a predetermined field, The aligner characterized by having the heat insulation member which intercepts the heat which it is arranged between the 2nd stage in which the metering device which

measures the condition of said exposure beam was carried, and said 1st stage and said 2nd stage, and is conducted from said 2nd stage.

[Claim 13] It is the aligner with which it is an aligner according to claim 12, and said heat insulation member is characterized by being the low solid material or the gas by which the temperature control was carried out of thermal conductivity.

[Claim 14] In the aligner which projects on a substrate the pattern formed in the mask through projection optics The 1st stage which holds said substrate and moves in a predetermined field, and the 2nd stage in which the metering device which measures the image formation property of said projection optics was carried, The aligner characterized by having the heat insulation member which intercepts the heat which it is arranged between said 1st stage and said 2nd stage, and is conducted from said 2nd stage.

[Claim 15] It is the aligner with which it is an aligner according to claim 14, and said heat insulation member is characterized by being the low solid material or the gas by which the temperature control was carried out of thermal conductivity.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

[Field of the Invention] lithography for this invention to manufacture a semiconductor device, a liquid crystal display component, or the thin film magnetic head -- it is in process, and it is used for the aligner equipped with the metering device for measuring a condition or an image formation property of an exposure beam etc. especially about the aligner used in order to imprint a mask pattern on a photosensitive substrate, and is suitable.

**[0002]**

[Description of the Prior Art] When manufacturing a semiconductor device etc., the projection aligner (stepper) of an one-shot exposure mold was conventionally used abundantly at the process imprinted on the wafers (or glass plate etc.) with which the pattern of the reticle as a mask was applied to the resist through projection optics under a predetermined exposure light. Recently, in order to imprint the pattern of the reticle of a large area with high precision, without enlarging projection optics, the projection aligner (scanning aligner) of a scan exposure mold like step - exposed by carrying out the synchronous scan of a reticle and the wafer to projection optics and - scanning method also attracts attention.

[0003] In these aligners, it is always proper light exposure, and the reticle stage which positions a reticle since it is necessary to expose where a high image formation property is maintained, or the wafer stage which performs positioning of a wafer is equipped with the metering device for measuring image formation properties, such as conditions, such as an illuminance of exposure light, and a projection scale factor. For example, there is a space image detection system for measuring the exposure monitor for measuring the incidence energy of the exposure light to projection optics as a metering device with which the wafer stage is equipped, a location, contrast of a projection image, etc. On the other hand, as a metering device which it has on the reticle stage, there is an orientation plate with which the index mark used for image formation property measurement of projection optics, for example was formed.

**[0004]**

[Problem(s) to be Solved by the Invention] In the conventional aligner like the above, while rationalization of light exposure was attained using the metering device formed in the reticle stage or the wafer stage, the high image formation property was maintained. On the other hand, it is also required that the throughput (productivity) of the exposure process at the time of manufacturing a semiconductor device etc. should be raised to the latest aligner. As an approach for raising a throughput, the drive rate of a stage other than the approach to which the exposure energy per unit time amount is made to increase is enlarged, with an one-shot exposure mold, stage stepping time is shortened and there is the approach of shortening stage stepping time and the scan exposure time in a scan exposure mold.

[0005] Thus, in order to raise a drive rate with the drive motor of the conversely same output as the former, it is necessary to miniaturize and to lightweight-ize a stage system that what is necessary is just to use the drive motor of an output larger when a stage system is the same magnitude in order to raise the drive rate of a stage. However, if the drive motor of a larger output is used like the former, the heating value generated from the drive motor will increase. Thus, the increasing heating value produces delicate heat deformation of a stage system, and has a possibility that the high positioning

accuracy demanded with the aligner may no longer be acquired. Then, in order to prevent degradation of positioning accuracy and to improve a drive rate, a miniaturization and lightweight-ization are expected a stage system as much as possible like the latter.

[0006] Especially, in the aligner of a scan exposure mold, while the scan exposure time is also shortened by improvement in a drive rate and a throughput is greatly improved, there is a big advantage that the synchronous precision of a reticle and a wafer also improves and the image formation engine performance and superposition precision also improve by the miniaturization of a stage system. However, when the reticle stage or the wafer stage is equipped with various metering devices like before, it is difficult to miniaturize a stage.

[0007] Furthermore, when the reticle stage or the wafer stage is equipped with the metering device for measuring a condition or an image formation property of exposure light etc., while the heat source of amplifier etc. is usually attached to the metering device, the temperature of the metering device rises gradually by the exposure of exposure light during measurement. Consequently, a reticle stage or a wafer stage carries out heat deformation delicately, and there is also a possibility that positioning accuracy, superposition precision, etc. may deteriorate. In the present condition, although degradation of the positioning accuracy by the temperature rise of a metering device etc. is slight, it is expected that the need of controlling the effect of the temperature rise of a metering device increases as circuit patterns, such as a semiconductor device, will make it detailed further from now on.

[0008] This invention is in the condition which maintained the function which measures the condition or image formation property of exposure light in view of this point, and it sets it as the 1st purpose to offer the aligner which can miniaturize the stage for positioning a reticle or a wafer. Furthermore, this invention sets it as the 2nd purpose to offer the aligner which can mitigate the bad influence of the temperature rise at the time of measuring using the metering device while it is equipped with the metering device which measures the condition or image formation property of exposure light.

[0009]

[Means for Solving the Problem] In the aligner which imprints the pattern with which the 1st aligner by this invention was formed in the mask (R) on a substrate (W) using an exposure beam The 1st stage which holds either of the mask and its substrate, and moves in a predetermined field (RST;WST), It has the 2nd stage (5; 14) which became independent of that 1st stage, and the metering device (6; 18) which is attached in this 2nd stage and measures the condition of that exposure beam.

[0010] According to this this invention, since magnitude of the 1st stage is made to necessary minimum by giving only the minimum function required for exposure to the 1st stage used for original exposure, the miniaturization of a stage and lightweight-ization are attained. Since the metering device which there is no direct need in exposure and, on the other hand, measures conditions, such as an illuminance of an exposure beam, is carried in 2nd another stage, it can also measure the condition of an exposure beam.

[0011] In this case, an example of that metering device is the photoelectrical sensor which measures the power of the whole exposure beam, or an illuminance unevenness sensor which measures the illumination distribution of that exposure beam. Moreover, the 1st stage is arranged independently free [ migration ] on the migration side of the 1st stage, using the 2nd stage as an example. At this time, the condition of the exposure beam near the field where a mask or a substrate is actually arranged is measurable by arranging that 2nd stage instead of that 1st stage.

[0012] Moreover, it is desirable to have the control unit (10) to which the 1st stage is moved between the location where the exposure beam is irradiated, and the location where the exposure beam is not irradiated. At this time, that 1st stage shunts the exposure location of an exposure beam at the time of measurement. Moreover, it is desirable to have the control unit (10) to which the 2nd stage is moved between the location where the exposure beam is irradiated, and the location where the exposure beam is not irradiated. By this, the metering device of the 2nd stage moves to the exposure location of an exposure beam at the time of measurement.

[0013] Moreover, when the 1st stage is located in the location which can irradiate the exposure beam, it is desirable to have the control unit (10) which positions the 2nd stage in the location where

the exposure beam is not irradiated. It is at the exposure and measurement time, and this uses two stages properly efficiently. Next, the 2nd aligner by this invention is set to the aligner which projects the pattern formed in the mask (R) on a substrate (W) through projection optics (PL). The 1st stage (WST) which holds that substrate and moves in a predetermined field, and its 1st stage are equipped with the metering device (20) which is arranged on the 2nd independent stage (14) and this 2nd stage, and measures the image formation property of that projection optics.

[0014] According to this this invention, the miniaturization of the 1st stage and lightweight-ization are attained by giving only the minimum function required for exposure to the 1st stage used for original exposure. Since the metering device which there is no direct need in exposure and, on the other hand, measures image formation properties, such as distortion, is carried in 2nd another stage, it can also measure an image formation property.

[0015] In this case, an example of that metering device is a position sensor, an index mark for measurement, or datum level for measurement of a projection image etc. Moreover, the 1st stage is arranged independently free [ migration ] on the migration side of the 1st stage, using the 2nd stage as an example. At this time, the image formation property in the field where that substrate is actually arranged is measurable by arranging that 2nd stage instead of that 1st stage.

[0016] Moreover, it is desirable to have the control unit (10) to which that 1st stage is moved between the location in the exposure field by that projection optics and the position of the outside of this exposure field. At this time, that 1st stage shunts an exposure field at the time of measurement. It is desirable similarly to have the control unit (10) to which that 2nd stage is moved between the location in the exposure field by that projection optics and the position of the outside of this exposure field. At this time, the metering device of that 2nd stage moves to an exposure field at the time of measurement.

[0017] Next, the 3rd aligner of this invention has the stage (41) where the metering device (18 19) which measures the condition of that exposure beam has been arranged, and the cooling system (44, 45A, 45B) with which this stage is equipped and which cools that metering device in the aligner which imprints the pattern formed in the mask (R) on a substrate (W) using an exposure beam. According to this this invention, in case the illuminance of an exposure beam etc. is measured using the metering device, even if the metering device carries out a temperature rise, since it is cooled by the cooling system, the effect of the temperature rise does not attain to the exposure section.

[0018] Next, the 4th aligner of this invention has the stage (41) where the metering device (20, 42, 43) which measures the image formation property of that projection optics has been arranged, and the cooling system (44, 45A, 45B) with which this stage is equipped and which cools that metering device in the aligner which projects the pattern formed in the mask (R) on a substrate (W) through projection optics (PL). According to this this invention, in case an image formation property is measured using the metering device, even if the metering device carries out a temperature rise, since it is cooled by the cooling system, the effect of the temperature rise does not attain to the exposure section.

[0019] Next, the 5th aligner of this invention is set to the aligner which imprints the pattern formed in the mask (R) on a substrate (W) using an exposure beam. The 1st stage which holds either of the mask and its substrate, and moves in a predetermined field (WST;41A), It is arranged between the 2nd stage (14;41Aa) in which the metering device (18 19) which measures the condition of the exposure beam was carried, and its 1st stage and its 2nd stage, and has the heat insulation member (48) which intercepts the heat conducted from the 2nd stage. According to this this invention, in case the illuminance of an exposure beam etc. is measured using the metering device, whether the metering device includes the heat source or the metering device carries out a temperature rise, heat conduction is checked by the heat insulation member, and the effect of the heat source or temperature rise does not attain to the exposure section by it.

[0020] In this case, an example of that heat insulation member is a solid material with low thermal conductivity (48), or the gas by which the temperature control was carried out. The gas currently air-conditioned is used as a gas by which the temperature control was carried out. Next, the 6th aligner of this invention is set to the aligner which projects the pattern formed in the mask (R) on a substrate (W) through projection optics (PL). The 1st stage which holds the substrate and moves in a predetermined field (WST;41A), It is arranged between the 2nd stage (14;41Aa) in which the

metering device (20) which measures the image formation property of the projection optics was carried, and its 1st stage and its 2nd stage, and has the heat insulation member (48) which intercepts the heat conducted from the 2nd stage. According to this this invention, whether the metering device carries out a temperature rise in case an image formation property is measured using the metering device, or the metering device includes the heat source, or since heat conduction is checked by the heat insulation member, the effect of the temperature rise etc. does not attain to the exposure section.

[0021] Also in this case, an example of that heat insulation member is a solid material with low thermal conductivity (48), or the gas by which the temperature control was carried out.

[0022]

[Embodiment of the Invention] Hereafter, with reference to drawing 1 - drawing 4, it explains per gestalt of operation of the 1st of this invention. Drawing 1 shows the projection aligner of step - used by this example, and - scanning method, and the exposure light IL injected from the illumination system 1 containing a fly eye lens, a quantity of light monitor, an adjustable aperture diaphragm, a field diaphragm, a relay lens system, etc. for the exposure light source, beam plastic surgery optical system, and illumination distribution equalization illuminates the lighting field of the shape of a slit of the pattern side (inferior surface of tongue) of Reticle R through a mirror 2 and a condensing lens 3 in this drawing 1 at the time of exposure. As an exposure light IL, excimer laser light, such as KrF (wavelength of 248nm) or ArF (wavelength of 193nm), the higher harmonic of an YAG laser, or i line (wavelength of 365nm) of a mercury lamp can be used. By switching the adjustable aperture diaphragm within an illumination system 1, it is constituted so that the lighting of the request of the usual lighting, zona-orbicularis lighting, the so-called deformation lighting, the lighting of a small coherence factor (sigma value), etc. can be chosen. When the exposure light source is a laser light source, the main control system 10 which carries out control control of the actuation of the whole equipment controls the luminescence timing etc. through a non-illustrated laser power source.

[0023] It is reduced through projection optics PL for the projection scale factor beta (beta is 1/4 time or 1/5 time), and the image of the pattern in the lighting field 9 (refer to drawing 3) by the exposure light IL of Reticle R is projected on the exposure field 12 of the shape of a slit on the wafer W with which the photoresist was applied. The Z-axis is taken in parallel with the optical axis AX of projection optics PL hereafter, the X-axis is taken along the non-scanning direction (namely, direction perpendicular to the space of drawing 1) which intersects perpendicularly with the reticle R at the time of scan exposure, and the scanning direction of Wafer W in a flat surface perpendicular to the Z-axis, and a Y-axis is taken and explained along a scanning direction (namely, direction parallel to the space of drawing 1).

[0024] First, by the off-axis method for the alignment of Wafer W, the alignment sensor 16 of an image-processing method adjoins projection optics PL, and is formed, and the detecting signal of the alignment sensor 16 is supplied to the alignment processor in the main control system 10. The alignment sensor 16 is used in order to perform location detection of the mark for alignment (wafer mark) currently formed on Wafer W. Spacing (the amount of base lines) of the detection core of the alignment sensor 16 and the core of the projection image of the reticle R by projection optics PL is called for with high precision beforehand, and is memorized by the alignment processor in the main control system 10, and each shot field of Wafer W and the projection image of Reticle R pile it up with high precision from the detection result and its amount of base lines of the alignment sensor 16. Although not illustrated, above Reticle R, the reticle alignment microscope for detecting the alignment mark on Reticle R is arranged.

[0025] Next, Reticle R is held by vacuum adsorption on a reticle stage RST, and the reticle stage RST is laid free [ migration in the direction of Y ] through the pneumatic bearing on guide of two 4A arranged in parallel with the direction of Y, and 4B. Furthermore, in this example, the stage 5 for measurement is laid free [ migration in the direction of Y ] through the pneumatic bearing on guide 4A and 4B independently [ a reticle stage RST ].

[0026] Drawing 3 is the top view showing a reticle stage RST and the stage 5 for measurement, and in this drawing 3, along with the guides 4A and 4B extended in the direction (scanning direction) of Y, the reticle stage RST and the stage 5 for measurement are laid so that it may drive in the direction of Y with a non-illustrated linear motor etc., respectively. The die length of Guides 4A and 4B is set

up for a long time by the width of face of the stage 5 for measurement at least rather than the migration stroke of the reticle stage RST at the time of scan exposure. Moreover, the reticle stage RST is constituted combining the coarse adjustment stage where it moves in the direction of Y, and the jogging stage which can tune a two-dimensional location finely on this coarse adjustment stage. [0027] And the orientation plate 6 which consists of a long and slender glass plate in the direction of X is fixed on the stage 5 for measurement, and two or more index marks IM for image formation property measurement of projection optics PL are formed by predetermined arrangement on the orientation plate 6. the lighting field 9 of the shape of a slit of exposure light [ as opposed to Reticle R in an orientation plate 6 ] -- more -- exact -- the visual field by the side of the reticle R of projection optics PL -- a wrap -- things are equipped with all possible magnitude. By using an orientation plate 6, since it is not necessary to prepare the exclusive reticle for image formation property measurement and and the swap time of the reticle R for real exposure and its exclusive reticle also becomes unnecessary, an image formation property can be measured in high frequency, and aging of projection optics PL can be followed correctly.

[0028] Thus, in this example, the stage 5 for measurement for orientation plate 6 is formed independently, and the member for measurement is not carried besides Reticle R on the original reticle stage RST. That is, in order to equip a reticle stage RST only with necessary minimum scan and positioning function for scan exposure, miniaturization of a reticle stage RST and lightweightization are realized. Therefore, since a reticle stage RST can be scanned more at a high speed, the throughput of an exposure process improves. in contraction projection, since especially the scan speed of a reticle stage RST becomes twice [ 1/beta ] (for example, 4 times, 5 times, etc.) the scan speed of a wafer stage, the upper limit of a scan speed may be determined mostly in a reticle stage, and its throughput improves greatly especially by this example in this case.

[0029] Moreover, a laser beam is irradiated by the migration mirror of the side face of the direction of +Y of a reticle stage RST from laser interferometer 7Y installed in the direction of +Y to Guides 4A and 4B. + A laser beam is irradiated by the migration mirror of the side face of the direction of +X of a reticle stage RST from the biaxial laser interferometer 7X1 installed in the direction of X, and 7X2. By laser interferometer 7Y, 7X1, and 7X2, the X coordinate of a reticle stage RST, Y coordinate and an angle of rotation are measured, a measurement value is supplied to the main control system 10 of drawing 1, and the main control system 10 controls the rate and location of a reticle stage RST through a linear motor etc. based on the measurement value. Moreover, a laser beam is irradiated by the migration mirror of the side face of the direction of -Y of the stage 5 for measurement from laser interferometer 8Y installed in the direction of -Y to Guides 4A and 4B, and the Y coordinate of the stage 5 for measurement measured by laser interferometer 8Y is supplied to the main control system 10. The optical axis of the laser interferometers 7Y and 8Y of a Y-axis has passed through the core AX of the lighting field 9, i.e., the optical axis of projection optics PL, along the direction of Y, respectively, and laser interferometers 7Y and 8Y are always measuring the location of the scanning direction of a reticle stage RST and the stage 5 for measurement, respectively.

[0030] And at the time of measurement of an image formation property, a reticle stage RST is made to shunt in the direction of +Y, and if it moves in the direction of Y on the stage 5 for measurement so that an orientation plate 6 may cover the lighting field 9, a laser interferometer 7X1 and the laser beam from 7X2 will separate from the side face of a reticle stage RST, and will come to be irradiated by the migration mirror of the side face of the direction of +X of the stage 5 for measurement. Based on the measurement value obtained from laser interferometer 8Y and 7X1, and 7X2 at this time, the main control system 10 controls the location of the stage 5 for measurement with high precision through a linear motor etc. In addition, what is necessary is to form the alignment mark on the orientation plate 6 and just to detect the location of this mark using a reticle alignment microscope to carry out alignment of the orientation plate 6 to high degree of accuracy more to the lighting field 9 in this case.

[0031] On the other hand, although the location of the non-scanning direction of a reticle stage RST is not measured during measurement, if a reticle stage RST arrives at the bottom of the lighting field 9 for exposure, a laser interferometer 7X1 and the laser beam from 7X2 will come to be again irradiated by the migration mirror of a reticle stage RST. And since final alignment is performed

using a reticle alignment microscope, there is no un-arranging [ of a laser interferometer 7X1 and the laser beam from 7X2 breaking off ].

[0032] Return and Wafer W are held through a non-illustrated wafer holder at the wafer stage WST top, and the wafer stage WST is laid by drawing 1 free [ migration in the direction of X, and the direction of Y ] through the pneumatic bearing on the surface plate 13. The focal leveling device which controls the location (focal location) of the Z direction of Wafer W and a tilt angle is also included in the wafer stage WST. Moreover, the stage 14 for measurement where it had various kinds of metering devices in the direction of X and the direction of Y free [ migration ] through the pneumatic bearing with another object is laid in the wafer stage WST on the surface plate 13. The device which controls the focal location of the top face is included also in the stage 14 for measurement.

[0033] Drawing 2 is the top view showing the wafer stage WST and the stage 14 for measurement, and is set to this drawing 2. In the interior of the front face of a surface plate 13, a coil train is embedded in a predetermined array. In the base of the wafer stage WST, and the base of the stage 14 for measurement, a magnet train is embedded with York, respectively. A flat-surface motor is constituted by that coil train and the corresponding magnet train, respectively, and the location of the direction of X of the wafer stage WST and the stage 14 for measurement and the direction of Y and the angle of rotation are controlled by this flat-surface motor mutually-independent. In addition, about the flat-surface motor, it is indicated more by the detail, for example in JP,8-51756,A.

[0034] The wafer stage WST of this example is equipped only with the minimum function required for exposure. That is, while the wafer stage WST is equipped with a focal leveling machine, on the wafer stage WST, two members of the wafer holder (base side of Wafer W) which carries out adsorption maintenance of the wafer W, and the reference mark plate 17 for location measurement of the wafer stage WST are being fixed. On the reference mark plate 17, the reference mark (un-illustrating) used as the datum reference of the direction of X and the direction of Y is formed, and the physical relationship over the projection image of the wafer stage WST (wafer W) R, for example, a reticle, is detected by detecting the location of this reference mark by the alignment sensor 16.

[0035] Moreover, the front face of the stage 14 for measurement is set as the almost same height as the front face of the wafer W on the wafer stage WST. And the illuminance unevenness sensor 19 which consists of a photoelectrical sensor for measuring the illumination distribution in the exposure field 12 of the shape of a slit by the exposure monitor 18 and the projection optics PL which consist of a photoelectrical sensor for measuring the energy per all unit time amount of the exposure light which passed projection optics PL (incidence energy), and the measurement plate 20 with which the slits 21X and 21Y for image-formation property measurement were formed are being fixed to the stage 14 for measurement. A condenser lens and a photoelectrical sensor are arranged at the slit 21X [ of the X-axis of the measurement plate 20 ], and base side of slit 21Y of a Y-axis, respectively, and the space image detection system consists of a measurement plate 20, a photoelectrical sensor, etc. In addition, the edge of rectangle opening may be used instead of the slits 21X and 21Y. And while the light-receiving side of the exposure monitor 18 is formed in wrap magnitude in the exposure field 12, the light sensing portion of the illuminance unevenness sensor 19 has become pinhole-like, and the detecting signal of the exposure monitor 18 and the illuminance unevenness sensor 19 is supplied to the main control system 10 of drawing 1.

[0036] Moreover, the detecting signal of the photoelectrical sensor of the pars basilaris ossis occipitalis of the measurement plate 20 is supplied to the image formation property operation system 11 of drawing 1. in this case, at the time of measurement of the image formation property of projection optics PL The orientation plate 6 on the stage 5 for measurement by the side of the reticle of drawing 3 is moved to the lighting field 9. The detecting signal from the photoelectrical sensor of a pars basilaris ossis occipitalis is incorporated by the image formation property operation system 11, the image of the index mark IM currently formed in the orientation plate 9 being projected on a wafer stage side, and scanning the image in the direction of X, and the direction of Y to the slits 21X and 21Y on the measurement plate 20, respectively. By the image formation property operation system 11, that detecting signal is processed, the location of the image of that index mark IM, contrast, etc. are detected, and it outputs to the main control system 10 in quest of image formation

properties, such as a curvature of field of a projection image, distortion, and a best focus location, from this detection result. Furthermore, although not illustrated, the device which drives the predetermined lens within projection optics PL, and amends image formation properties, such as a predetermined distortion, is also established, and the main control system 10 is constituted so that the image formation property of projection optics PL can be amended through this amendment device.

[0037] In drawing 2, sources of generation of heat, such as amplifier, and the power source, and the signal cable for a communication link are connected to sensors, such as the exposure monitor 18 with which the stage 14 for measurement is equipped, the illuminance unevenness sensor 19, and a photoelectrical sensor of the pars basilaris ossis occipitalis of the measurement plate 20, by each. Therefore, when those sensors are carried in the wafer stage WST for exposure, there is a possibility that positioning accuracy etc. may deteriorate with the tension of the heat source which accompanies a sensor, or a signal cable. Moreover, the heat energy by the exposure of the exposure light under measurement of an image formation property etc. also has a possibility of causing aggravation of positioning accuracy etc. On the other hand, in this example, since those sensors are formed in the stage 14 for measurement separated from the wafer stage WST for exposure, there is an advantage to which the fall of a miniaturization and the positioning accuracy by the heat source of the sensor for measurement or the heat energy of the exposure light under measurement while being able to carry out [ lightweight ]-izing can prevent the wafer stage WST. While the passing speed and the controllability of the wafer stage WST improve and the throughput of an exposure process increases by the miniaturization of the wafer stage WST, positioning accuracy etc. improves more.

[0038] Moreover, a laser beam is irradiated by the migration mirror of the side face of the direction of +Y of the wafer stage WST from laser interferometer 15Y installed in the direction of +Y to the surface plate 13. - A laser beam is irradiated by the migration mirror of the side face of the direction of -X of the wafer stage WST from the biaxial laser interferometer 15X1 installed in the direction of X, and 15X2. The X coordinate of the wafer stage WST, Y coordinate, and an angle of rotation are measured by laser interferometer 15Y, 15X1, and 15X2, a measurement value is supplied to the main control system 10 of drawing 1, and the main control system 10 controls the rate and location of the wafer stage WST by them through a flat-surface motor based on the measurement value. Moreover, at the time of measurement of the incidence energy of exposure light etc., the laser beam for those location measurement is irradiated by the migration mirror of the stage 14 for measurement.

[0039] Drawing 4 The wafer stage WST at the time of measurement of the incidence energy of exposure light etc., And the wafer stage WST is made to shunt in the location distant from the exposure field 12, as an example of arrangement of the stage 14 for measurement is shown and it is shown in this drawing 4. If it moves on the stage 14 for measurement so that the exposure field 12 may start on the stage 14 for measurement, the laser beam from laser interferometer 15Y, 15X1, and 15X2 will separate from the side face of the wafer stage WST, and will come to be irradiated by the migration mirror of the side face of the stage 14 for measurement. Based on the measurement value obtained from laser interferometer 15Y and 15X1, and 15X2 at this time, the main control system 10 controls the location of the stage 14 for measurement with high precision through a flat-surface motor. In addition, since the location of the wafer stage WST and the stage 14 for measurement is roughly controllable also by driving a flat-surface motor with open-loop, in the condition that the laser beam is not irradiated, the main control system 10 drives the location of the wafer stage WST and the stage 14 for measurement by the open loop system using a flat-surface motor. However, the linear encoder for detecting the location of the wafer stage WST and the stage 14 for measurement other than laser interferometer 15Y, 15X1, and 15X2 in predetermined precision etc. is prepared, and location measurement may be performed in the condition that the laser beam is not irradiated, using those linear encoders etc.

[0040] Although not illustrated [ return and ] to drawing 1, in the side face of projection optics PL, a slit image is aslant projected on two or more measure points of the front face of Wafer W, and the focal location detection system (AF sensor) of an oblique incidence method which detects the focal location of the measure point which corresponds from the amount of strike slips of the slit image in which re-image formation is carried out by the reflected light is arranged. Based on the detection result of the focal location detection system, the front face of the wafer W under scan exposure focuses to the image surface of projection optics PL. In addition, although omitted in drawing 2, on

the stage 14 for measurement, the criteria member which has the datum level for the focal location detection systems is also carried.

[0041] Next, it explains per actuation of the projection aligner of this example. First, the amount of incident light of the exposure light IL to projection optics PL is measured using the stage 14 for measurement by the side of a wafer stage. In this case, in order to measure the amount of incident light in the condition that Reticle R was loaded, in drawing 1, the reticle R for exposure is loaded on a reticle stage RST, and Reticle R moves onto the lighting field of the exposure light IL. Then, as shown in drawing 4, on a surface plate 13, it shunts in the direction of +Y and the stage 14 for measurement moves toward the exposure field 12 by projection optics PL on the wafer stage WST. Then, the stage 14 for measurement stops [ the light-receiving side of the dose monitor 18 on the stage 14 for measurement ] the exposure field 12 in a wrap location, and the quantity of light of the exposure light IL is measured through the dose monitor 18 in this condition.

[0042] By the main control system 10, the measured quantity of light is supplied to the image formation property operation system 11. under the present circumstances, it is alike, for example, the measurement value which detects the flux of light acquired from the exposure light IL by branching within an illumination system 1, and is obtained is also supplied to the image formation property operation system 11, and the multiplier for calculating indirectly the quantity of light which carries out incidence to projection optics PL is computed and memorized by the image formation property operation system 11 based on two measurement values from the quantity of light by which a monitor is carried out within an illumination system 1. In the meantime, Wafer W is loaded to the wafer stage WST. Then, as shown in drawing 2, the stage 14 for measurement shunts in the location distant from the exposure field 12, and migration of the wafer stage WST is performed so that the core of the wafer W on the wafer stage WST may be located near optical-axis AX (core of the exposure field 12) of projection optics PL. While the wafer stage WST is shunting, as shown in drawing 4, since the laser beam from laser interferometer 15Y, 15X1, and 15X2 is not irradiated, position control is performed by driving a flat-surface motor by the open loop system.

[0043] Then, when the stage 14 for measurement shunts the exposure field 12 and the laser beam from laser interferometer 15Y, 15X1, and 15X2 came to be irradiated by the wafer stage WST, the location of the wafer stage WST comes to be controlled based on the measurement value of those laser interferometers. Then, using the reticle alignment microscope of Reticle R which is not illustrated [ upper ], alignment of Reticle R is performed by driving a reticle stage RST so that the amount of location gaps of the predetermined alignment mark on Reticle R and the predetermined reference mark on the reference mark member 17 of drawing 2 may be made into predetermined desired value. The physical relationship (the amount of base lines) over the projection image of the reticle R of the wafer stage WST is correctly detected by detecting the location of another reference mark on the reference mark member 17 by the alignment sensor 16 of drawing 1 to coincidence mostly with this.

[0044] Next, the array coordinate of each shot field of Wafer W is searched for by detecting the location of the wafer mark attached to the predetermined shot field on Wafer W (sample shot) through the alignment sensor 16. Then, scan exposure is performed, performing alignment of the shot field for [ of Wafer W ] exposure, and the pattern image of Reticle R based on the array coordinate and the known amount of base lines of the alignment sensor 16.

[0045] Synchronizing with Reticle R being scanned at a rate VR in the direction (or the direction of -Y) of +Y through a reticle stage RST in drawing 1 to the lighting field 9 (referring to drawing 3) of the exposure light IL at the time of scan exposure, Wafer W is scanned by rate beta-VR (beta is a projection scale factor) in the direction of -X (or the direction of +X) through the wafer stage WST to the exposure field 12. It is because projection optics PL projects a reversal image that a scanning direction is reverse. And after the exposure to one shot field is completed, the next shot field moves to a scan starting position, and exposure to each shot field is hereafter performed one by one by stepping of the wafer stage WST by step - and - scanning method. As shown during this scan exposure at drawing 2 and drawing 3, the stage 14 for measurement by the side of a wafer stage and the stage 5 for measurement by the side of a reticle stage have shunted outside an exposure field, respectively.

[0046] During exposure, the quantity of light of the flux of light which branched from the exposure

light IL for example, within the illumination system 1 is always measured, and the image formation property operation system 11 is supplied. Moreover, by the image formation property operation system 11 The measurement value of the quantity of light supplied and the quantity of light of the exposure light IL which carries out incidence to projection optics PL based on the multiplier for which it has asked beforehand are computed. The variation of the image formation properties (a projection scale factor, distortion, etc.) of the projection optics PL generated by absorption of the exposure light IL is calculated, and this count result is supplied to the main control system 10. By the main control system 10, the image formation property is amended by driving the predetermined lens within projection optics PL, for example.

[0047] Although the above is the usual exposure, when measuring a device status by the maintenance of the projection aligner of this example etc., it measures by moving the stage 14 for measurement to the exposure field 12 side. For example, when measuring the illuminance homogeneity in the exposure field 12, after removing Reticle R from a reticle stage RST, illumination distribution is measured in drawing 4, moving the illuminance unevenness sensor 19 slightly in the direction of X, and the direction of Y in the exposure field 12. In this case, as long as it is necessary to ask accuracy for the location of the stage 14 for measurement more, the reference mark member which is equivalent to the reference mark member 17 like the wafer stage WST is prepared on the stage 14 for measurement, and you may make it measure the location of the reference mark in that reference mark member by the alignment sensor 16.

[0048] Next, it explains per [ which measures image formation measurement of projection optics PL ] actuation using the stage 5 for measurement by the side of a reticle stage, and the stage 14 for measurement by the side of a wafer stage. In this case, in drawing 3, a reticle stage RST shunts in the direction of +Y, and the orientation plate 6 on the stage 5 for measurement moves into the lighting field 9 in it. In order for the laser interferometer 7X1 of a non-scanning direction and the laser beam from 7X2 to also be irradiated by the stage 5 for measurement at this time, based on the measurement value of laser interferometer 8Y, 7X1, and 7X2, the location of the stage 5 for measurement can be positioned with high precision.

[0049] At this time, as already explained, the image of two or more index marks IM is projected on a wafer stage side through projection optics PL. In this condition, the location of those images and contrast are searched for in drawing 4 by driving the stage 14 for measurement, scanning the image of that index mark IM in the direction of X, and the direction of Y to the slit on the measurement plate 20, and processing the detecting signal of the photoelectrical sensor of the pars basilaris ossis occipitalis of the measurement plate 20 by the image formation property operation system 11. Moreover, the location of those images and contrast are searched for, changing the focal location of the measurement plate 20 the specified quantity every. From these measurement results, the image formation property operation system 11 calculates the amount of fluctuation of image formation properties, such as a best focus location of the projection image of projection optics PL, a curvature of field, and distortion (a scale-factor error is included). When this amount of fluctuation is supplied to the main control system 10 and that amount of fluctuation exceeds tolerance, the main control system 10 amends the image formation property of projection optics PL.

[0050] With the gestalt of the above-mentioned operation, as shown in drawing 2, the wafer stage WST and the stage 14 for measurement are driven by the flat-surface motor on the surface plate 13, respectively. However, the configuration which drives the wafer stage WST and the stage 14 for measurement two-dimensional with the combination of a 1-dimensional motor is also possible. Then, with reference to drawing 5, it explains about the gestalt of the 2nd operation which drives a wafer stage and the stage for measurement next by the device which combined the 1-dimensional motor, respectively. This example also applies this invention to the projection aligner of step - and - scanning method, gives the same sign to the part corresponding to drawing 1 and drawing 2 in drawing 5, and the detail explanation is omitted.

[0051] The long and slender Y-axis linear guide 32 is installed in the direction (scanning direction) of Y so that the top view and drawing 5 (b) which show the wafer stage side of the projection aligner of this example are the front view, the X-axis linear guides 34A and 34B of two may be installed in the top face of a surface plate 33 in parallel along the direction of X and drawing 5 (a) may connect the X-axis linear guides 34A and 34B in drawing 5 (a) and (b). The Y-axis linear guide 32 is driven

in the direction of X along with the X-axis linear guides 34A and 34B with a non-illustrated linear motor.

[0052] Moreover, along with the Y-axis linear guide 32, the wafer stage 31 and the stage 35 for measurement are arranged free [migration] and mutually-independent in the direction of Y, respectively, on the wafer stage 31, adsorption maintenance of the wafer W is carried out through a non-illustrated wafer holder, the exposure monitor 18, the illuminance unevenness sensor 19, and the measurement plate 20 are fixed on the stage 35 for measurement, and the photoelectrical sensor is incorporated by the pars basilaris ossis occipitalis of the measurement plate 20. In this case, the base of the wafer stage 31 and the stage 35 for measurement is laid on a surface plate 33 through a pneumatic bearing, respectively, and the wafer stage 31 and the stage 35 for measurement are independently driven in the direction of Y along with the Y-axis linear guide 32 through a non-illustrated linear motor, respectively. That is, the wafer stage 31 and the stage 35 for measurement are independently driven two-dimensional along with the Y-axis linear guide 32 and the X-axis linear guides 34A and 34B, respectively. And also in this example, the two-dimensional location of the wafer stage 31 and the stage 35 for measurement is measured, and the location and drive rate of the wafer stage 31 and the stage 35 for measurement are controlled by the same laser interferometer of four shafts as laser interferometer 7Y by the side of the reticle stage of drawing 3, 7X1, 7X2, and 8Y based on this measurement result. Other configurations are the same as that of the gestalt of the 1st operation.

[0053] In this example, in case the exposure energy of exposure light or the image formation property of projection optics is measured, the wafer stage 31 shunts in the location left in the direction of -Y to the exposure field by exposure light, and the stage 35 for measurement moves to the exposure field. On the other hand, the stage 35 for measurement shunts in the location left in the direction of +Y to the exposure field by exposure light at the time of exposure. Then, after making stepping of the wafer stage 31 carry out in the direction of X, and the direction of Y and moving the shot field for [on Wafer W] exposure to the scan starting position to an exposure field, scan exposure to the shot field concerned is performed by carrying out constant-speed migration of the wafer stage 31 in the direction of Y along with the Y-axis linear guide 32.

[0054] According to this example, along with the Y-axis linear guide 32, the stage 35 for measurement is arranged independently [the wafer stage 31] as mentioned above. By this configuration, by the drive of the scanning direction (the direction of Y) where the control precision of a higher stage is demanded, while not driving the stage 35 for measurement, a miniaturization and since it is lightweight-sized, the wafer stage 31 can improve a scan speed and its synchronous precision at the time of scan exposure etc. is improving. On the other hand, since the stage 35 for measurement is also driven to coincidence to a non-scanning direction (the direction of X), the load to a drive becomes large. However, since so high control precision is not required compared with a scanning direction, the effect of an increment of such a load is small in a non-scanning direction. Furthermore, since the stage 35 for measurement as a source of generation of heat is separated from the wafer stage 31, the fall of the positioning accuracy of the wafer stage 31 etc. is prevented.

[0055] In addition, in this example, as a two-dot chain line shows, the 2nd Y-axis linear guide 36 may be arranged free [migration in the direction of X] to the Y-axis linear guide 32 and juxtaposition at drawing 5 (a) and (b), and the stage 35 for measurement may be arranged free [migration in the direction of Y] to this Y-axis linear guide 32. By this, the control precision at the time of driving the wafer stage 31 in the direction of X also improves.

[0056] Moreover, although the reticle stage RST and the stage 5 for measurement are arranged along with the same guides 4A and 4B as shown in drawing 3, you may enable it to move independently a reticle stage RST and the stage 5 for measurement by the gestalt of the 1st operation of the above two-dimensional like the wafer stage side of drawing 2. Furthermore, although the wafer stage WST in which Wafer W is laid, and one 31 are prepared with the gestalt of the above-mentioned operation, respectively, two or more wafer stages in which Wafer W is laid may be prepared. In this case, it can expose on one wafer stage and the approach of performing the measurement or wafer exchange for alignment on the wafer stage of another side can also be used. Similarly two or more reticle stages where Reticle R is laid also in a reticle stage side are prepared, and a reticle which is different in the reticle stage of these plurality is laid, and exposure conditions (a focal location, light

exposure, lighting conditions, etc.) are changed into the same shot field on a wafer one by one, and you may make it expose these reticles.

[0057] Next, with reference to drawing 6 and drawing 7, it explains per gestalt of operation of the 3rd of this invention. This example forms the cooling system which cools the metering device formed in the wafer stage, gives the same sign to the part corresponding to drawing 1 and drawing 2 in drawing 6 and drawing 7, and omits the detail explanation. Drawing 6 shows the projection aligner of this example, in this drawing 6, Wafer W is arranged at the exposure field 12 side by projection optics PL, and Wafer W is held on the wafer stage 41 through a non-illustrated wafer holder, and the wafer stage 41 is laid so that it may drive in the direction of X, and the direction of Y for example, by the flat-surface motor on a surface plate 13. Although not illustrated, in the wafer stage 41, the device which controls the focal location of Wafer W and a tilt angle is also incorporated. Furthermore, the measuring machine style of the exposure light IL and an image formation property is included in the wafer stage 41 so that Wafer W may be surrounded.

[0058] Drawing 7 shows the top view of the wafer stage 41 of drawing 6, and the reference mark member 17, the exposure monitor 18, the illuminance unevenness sensor 19, and the measurement plate 20 with which Slits 21X and 21Y were formed are arranged near the wafer W (wafer holder) in this drawing 7. Moreover, matching of the illuminance between different projection aligners can be taken now by forming the crevice 47 for installing the criteria illuminometer carried and made near the exposure monitor 18, installing a criteria illuminometer in a crevice 47, and measuring the incidence energy of the exposure light IL on the wafer stage 41. Furthermore, the criteria member 46 by which the base plane used as criteria, such as display flatness, was formed in a corner on the wafer stage 41 is also being fixed. In this example, the cooling system for cooling the heat source of these measuring machine styles is formed.

[0059] That is, amplifier etc. is connected to the photoelectrical sensor 43, although the condenser lens 42 and the photoelectrical sensor 43 have been arranged at the pars basilaris ossis occipitalis of slit 21Y of the measurement plate 20 and it did not illustrate, as a part was cut to drawing 6 and was lacked and shown in it. Then, a cooling pipe 44 is installed so that it may pass near the photoelectrical sensor 43 inside the wafer stage 41, the refrigerant which becomes a cooling pipe 44 from an external cooling system from a low-temperature liquid through piping 45A which has big flexibility is supplied, and the refrigerant which passed through the inside of piping 45A is returned to the cooling system through piping 45B which has big flexibility. Moreover, the cooling pipe 44 has also passed the pars basilaris ossis occipitalis of the crevice 47 for criteria illuminometers, the reference mark member 17, and the criteria member 46 in the list near the exposure monitor 18 of drawing 7, and the illuminance unevenness sensor 19. In this example, since the heat energy from the heat source of the amplifier of these metering devices etc. is discharged through the refrigerant in a cooling pipe 44, the positioning accuracy of Wafer W etc. does not get worse with the heat energy. Moreover, even when the exposure light IL is irradiated by the exposure monitor 18 and the illuminance unevenness sensor 19 at the time of measurement of the incidence energy of the exposure light IL etc., since the exposure energy is discharged through the refrigerant in a cooling pipe 44, the positioning accuracy of Wafer W etc. does not get worse with the exposure energy.

[0060] In addition, although the metering device is cooled in this example using the refrigerant which consists of a liquid, you may cool by ventilating the air for air-conditioning etc. intensively near those metering devices, for example. Next, with reference to drawing 8, it explains per gestalt of operation of the 4th of this invention. This example prepares a heat insulation member on a wafer stage between the arrangement field (the 1st stage) of a wafer, and the arrangement field (the 2nd stage) of a metering device, gives the same sign to the part corresponding to drawing 7 in drawing 8, and omits the detail explanation.

[0061] Drawing 8 showed wafer stage 41A which drives a surface plate top as well as the wafer stage 41 of drawing 7 in the direction of X, and the direction of Y, and the upper part of wafer stage 41A is divided into metering-device installation field 41Aa and the other field in this drawing 8 with the heat insulation plate 48 which consists of an ingredient with low thermal conductivity. As an ingredient with the low heat conductivity, metals, such as stainless steel, iron, and brass, the ceramics, or glass can be used. And while Wafer W is laid through a wafer holder (un-illustrating) on the latter field, the reference mark member 17 used as a datum reference is installed, and

reference mark member 17A by which the mark used as a datum reference was formed in the former metering-device installation field 41Aa, the exposure monitor 18, the illuminance unevenness sensor 19, the criteria member 46 that has a base plane, and the measurement plate 20 with which the slit was formed are arranged. Furthermore, on metering-device installation field 41Aa, the crevice 47 for installing a criteria illuminometer is formed.

[0062] In this example, although the metering device in metering-device installation field 41Aa is used at the time of measurement of exposure light or an image formation property, since it is hard to diffuse the heat energy generated with the amplifier of these metering devices etc. with a heat insulation plate 48 in Wafer W side, the positioning accuracy of Wafer W etc. does not get worse. Similarly, the exposure energy given by exposure light at the time of measurement also has the advantage which is hard to diffuse in Wafer W side with a heat insulation plate 48.

[0063] In addition, as shown, for example in drawing 2, the configuration which the wafer stage WST and the stage 14 for measurement have separated can also consider that the air by which it was air-conditioned between the wafer stage WST and the stage 14 for measurement is a heat insulation member. Moreover, you may make it a reticle stage side also arrange a heat insulation member between the field in which a reticle is laid, and the field in which a metering device is installed.

[0064] Moreover, although the gestalt of the above-mentioned operation applies this invention to the projection aligner of step - and - scanning method, this invention is applicable also to the aligner of the pro squeak tee method which does not use projection optics while it is applicable also to the projection aligner (stepper) of an one-shot exposure mold. Moreover, you may use for the test equipment which uses the stage for positioning not only an aligner but a wafer etc., or repair equipment.

[0065] Thus, this invention is not limited to the gestalt of above-mentioned operation, but can take configurations various in the range which does not deviate from the summary of this invention.

[0066]

[Effect of the Invention] Since the 2nd stage equipped with the metering device to the 1st stage for moving a mask or a substrate is prepared independently according to the 1st or 2nd aligner of this invention, the condition of an exposure beam (exposure light), or where the function which measures the image formation property of projection optics is maintained, there are a miniaturization and an advantage which can carry out [lightweight]-izing about the stage for positioning a mask or a substrate, respectively. Therefore, while the controllability ability of these stages can be improved and the throughput of an exposure process also improves, the heat source of the photoelectrical sensor which constitutes a metering device, or amplifier will be separated from the stage for exposure, and superposition precision etc. improves. If especially this invention is applied to the aligner of a scan exposure mold like step - and - scanning method, since a throughput will improve greatly by improvement in a scan speed, especially the effectiveness of this invention is large.

[0067] When the 2nd stage is arranged independently free [the 1st stage] for migration in these cases, the 1st stage can be quickly moved to a measurement field. Moreover, when it has the control device to which the 1st stage is moved between the location (exposure field) where an exposure beam is irradiated, and the location (non-exposing field) where an exposure beam is not irradiated, the 1st stage can be quickly shunted at the time of measurement.

[0068] Moreover, when it has the control device to which the 2nd stage is moved between the location (exposure field) where an exposure beam is irradiated, and the location (non-exposing field) where an exposure beam is not irradiated, the 2nd stage can be quickly shunted at the time of exposure. Moreover, when it has the control device which positions the 2nd stage in the location where an exposure beam is not irradiated when the 1st stage is located in the location which can irradiate an exposure beam, these two stages can be used properly efficiently.

[0069] Next, since it has the cooling system which cools a metering device according to the 3rd or 4th aligner of this invention, the bad influence of the temperature rise at the time of measuring the condition of an exposure beam or the image formation property of projection optics can be mitigated, and there is an advantage positioning accuracy and whose superposition precision improve.

Moreover, according to the 5th or 6th aligner of this invention, since it has the heat insulation member between two stages, the bad influence of the temperature rise at the time of measuring the condition of an exposure beam or the image formation property of projection optics can be mitigated,

and there is an advantage positioning accuracy and whose superposition precision improve. [0070] Moreover, when the heat insulation member is a solid material with the low heat conductivity, while these two stages can be driven as one, when the heat insulation member is the gas by which the temperature control was carried out, the effectiveness of a miniaturization of the 1st stage is also acquired.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]** It is the outline block diagram showing the projection aligner of the gestalt of operation of the 1st of this invention.

**[Drawing 2]** It is the top view showing the wafer stage WST and the stage 14 for measurement of drawing 1 .

**[Drawing 3]** It is the top view showing the reticle stage RST and the stage 5 for measurement of drawing 1 .

**[Drawing 4]** In the gestalt of the 1st operation, it is the top view with which the explanation in the case of measuring the condition of exposure light etc. using the stage 14 for measurement is presented.

**[Drawing 5]** The top view in which (a) shows the wafer stage and the stage for measurement of a projection aligner of operation of the 2nd of this invention, and (b) are the front views of **drawing 5** (a). [ of a gestalt ]

**[Drawing 6]** It is the outline block diagram which cut and lacked the part which shows the projection aligner of the gestalt of operation of the 3rd of this invention.

**[Drawing 7]** It is the top view showing the wafer stage of the projection aligner of **drawing 6** .

**[Drawing 8]** It is the top view showing the wafer stage of the projection aligner of the gestalt of operation of the 4th of this invention.

**[Description of Notations]**

R Reticle

RST Reticle stage

4A, 4B Guide

5 Stage for Measurement by the side of Reticle Stage

6 Orientation Plate

PL Projection optics

W Wafer

WST, 31, 41, 41A Wafer stage

10 Main Control System

11 Image Formation Property Operation System

13 Surface Plate

14 35 Stage for measurement by the side of a wafer stage

17 Reference Mark Member

18 Exposure Monitor

19 Illuminance Unevenness Sensor

20 Measurement Plate

32 Y-axis Linear Guide

33 Surface Plate

34A, 34B X-axis linear guide

48 Heat Insulation Plate

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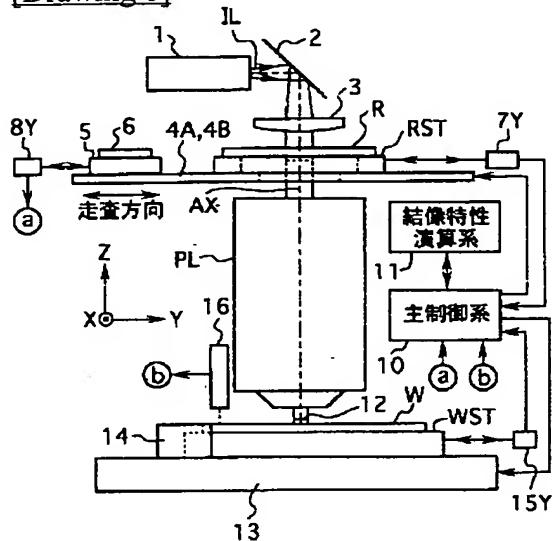
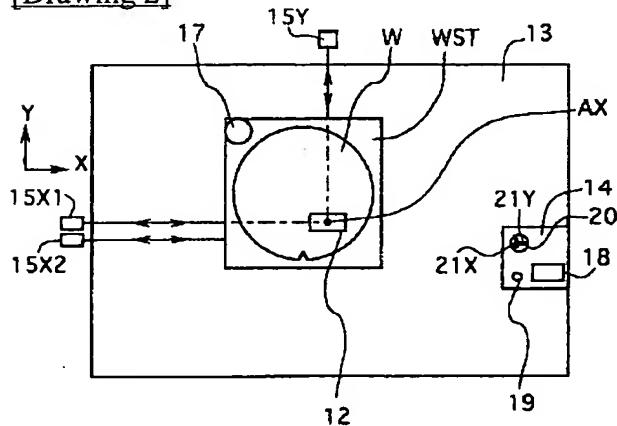
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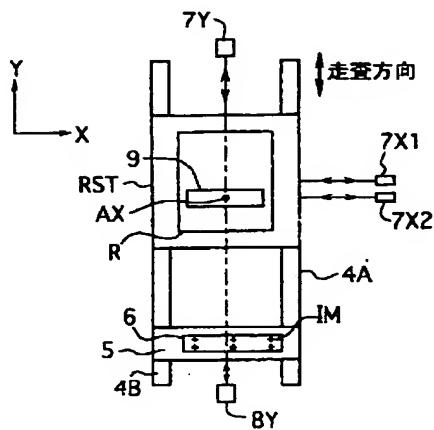
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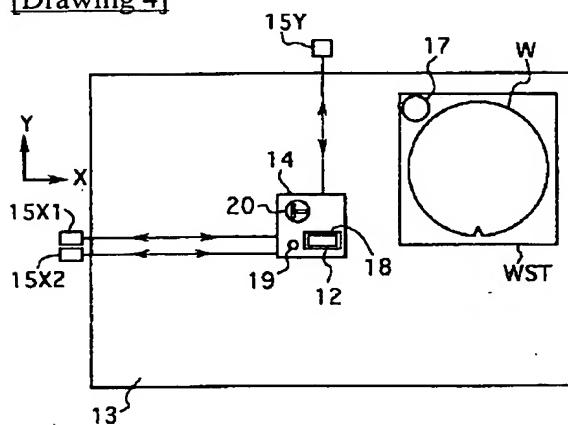
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## DRAWINGS

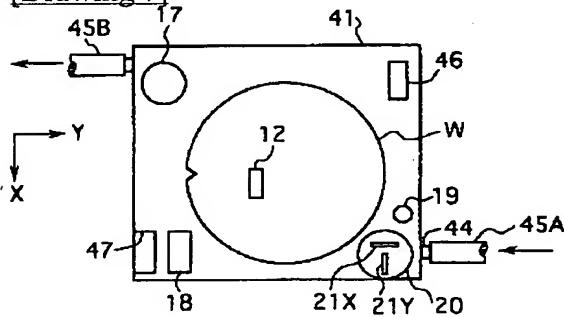
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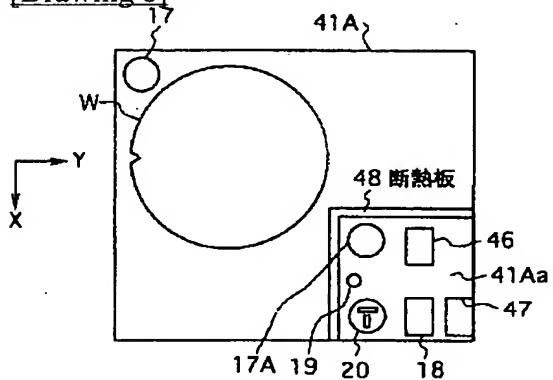
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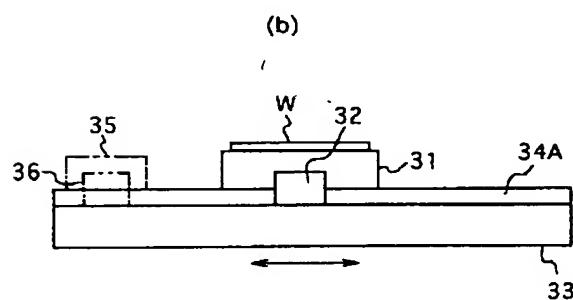
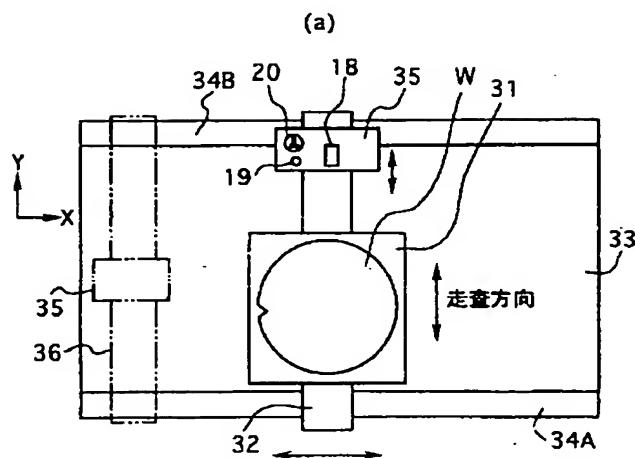
[Drawing 7]



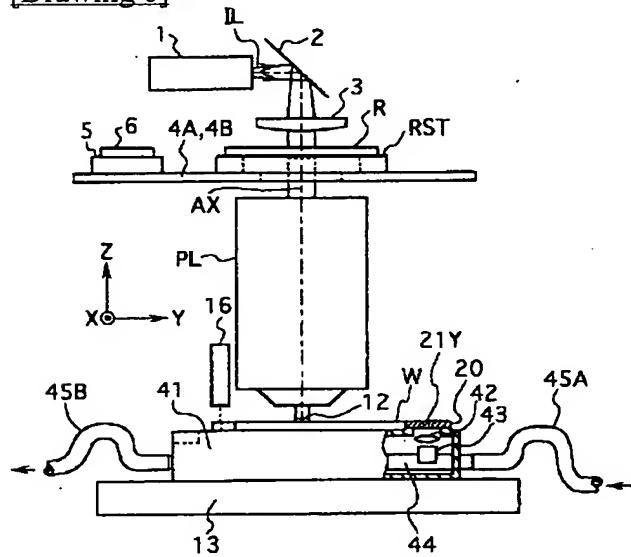
[Drawing 8]



[Drawing 5]



[Drawing 6]



[Translation done.]